

## Diversity, Distribution and Host Range of Mistletoes in Godawari–Phulchoki Area, Kathmandu, Nepal

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Present study describes the diversity, distribution and host range of mistletoes species in Godawari–Phulchoki area, Nepal. Total 69 host species representing 57 genera from 38 families were parasitized by 10 mistletoes species. *Scurrula parasitica* and *Helixanthera ligustrina* respectively parasitized 38 and 25 host species. Most of the host species were belonging to the families Rosaceae, Rutaceae and Fagaceae. The host species *Castanea sativa*, *Populus deltoids*, *Callistemon citrinus* and *Pyrus pashia* were efficient possessing the largest number of mistletoes infestations. Of the 10 mistletoes species, four species were solely from the genus *Scurrula*. *Scurrula gracilifolia*, *Macrosolen cochinchinensis*, and *Viscum loranthe* were new records from Kathmandu Valley. Observations of *Scurrula parasitica* as hyperparasite on *S. pulverulenta* and *Viscum loranthe* as obligate epiparasite on *Loranthus odoratus* and *Macrosolen cochinchinensis* were noticeable.

**Key words:** Diversity, host range, Loranthaceae, mistletoes, Nepal.

Mistletoes, highly specialised flowering parasitic plants comprising 1306 species (Nickrent 2002) from a broad range of habitats, have been considered a successful polyphyletic group due to their ability to exploit hosts. They selectively infest trees and shrubs (Kunwar et al. 2005), and their greatest diversity is found in forests and woodlands (Kuijt 1969, Calder 1983, Hawksworth 1983). There is hardly any tree or shrub, which is immune to the attack of mistletoes (Johri and Bhatnagar 1972). Distinctively the array of their hosts ranges from the forest trees, avenue trees, orchard trees, ornamental trees, shrubs, thorny scrubs, to euphorbs and cacti.

An extensive compilation of host list of mistletoe *Viscum album* was 452 species from 96 genera under 44 families (Barney

et al. 1998) and of *Dendrophthoe falcata* was 401 (Hawksworth et al. 1993) from 227 genera under 77 families. The list was 319 for *D. falcata* from India (Singh 1962) and 48 for *Scurrula elata* from Central Nepal Himalayas (Devkota and Glatzel 2005). It was 81 and 29 for *S. pulverulenta* respectively from India (Pundir 1995) and Kathmandu Valley, Nepal (Devkota and Acharya 1996).

With the beginning of the 19th century a series of botanical explorations started in Nepal but the extensive mistletoes study remained unattained. The first record of mistletoes in Nepal was made in *Prodromus Flora Nepalensis* (D. Don 1825) mentioning seven species. After 60 years, Hooker (1888) enumerated seven species of mistletoes (two new species) from Nepal in his compilation

*Flora of British India*. The number of mistletoes species increased up to 10 in 1966 (Hara 1966) and 12 in 1976 (HMG/N 1976). Total 15 mistletoes species from Nepal was listed by Hara et al. (1982) in their compilation *Enumeration of the Flowering Plants of Nepal*. HMG/N (1986) and Devkota and Acharya (1996) reported nine mistletoes species each from Kathmandu Valley, however, the species were different. Note same as that of Hara et al. (1982) was made by Koba et al. (1994), Press et al. (2000) and HMG/N (2001). A record of three new species for Nepal was made by Devkota and Glatzel (2005) and of a new species for Nepal was maintained by Devkota and Koirala (2005). The number of mistletoes for Nepal is now 19 (Devkota 2005).

Mistletoes are important component of plant diversity and forest ecosystem due to their interactive role with other plants and animals. However, their detail studies on distribution, diversity and host range of mistletoes in Nepal is lacking. Limited studies neither reflect the field level data nor entail the management strategies. Present study was, therefore, an attempt to study the distribution, diversity and host range of mistletoes in Godawari-Phulchoki area, Kathmandu Valley, Nepal.

### Materials and Methods

**Study area** — Godawari-Phulchoki area, Kathmandu Valley ranging between 1,552–2,760 m elevation and well known for floral and faunal diversity was considered as study area. The area lies in the southeast corner of the Kathmandu Valley stretching between 27°33' to 27°36'N and 85°22' to 85°26'E and characterizing typical monsoon climate with wet summer and dry winter. Forestlands, premises of the Royal Botanical Garden, St. Xavier's school, honeybee development section, fishery research centre, horticulture centre and adjoining settlements of the study area were selected as study sites. The area is

dominated by *Schima wallichii*, *Castanopsis indica*, *Castanopsis tribuloides*, *C. hystrix*, *Quercus glauca*, *Lyonia ovalifolia*, *Michelia kisopa*, etc.

**Field survey** — Field survey was carried out from May 2004 to April 2005. Standard sized mistletoes specimens were collected carefully without endangering their local population, and herbarium specimens were prepared following Bridson and Forman (1992). Comparative analysis was made with relevant earlier publications. International Plant Name Index (<http://www.ipni.org>) was accessed for the taxonomic nomenclature of mistletoes and host species.

### Results and Discussion

**Diversity** — Total 69 host species representing 57 genera from 38 families (Table 1) were infested by 10 mistletoes species. Of the 10 species, seven belonged to four genera (*Helixanthera*, *Loranthus*, *Macrosolen* and *Scurrula*) under the family Loranthaceae and three belonged to single genus *Viscum* under the family Viscaceae. *Scurrula* was the largest genus possessing four species. The narrow host range of Viscaceous mistletoes shows a high degree of host specificity since they infest a limited number of hosts of few families despite their occurrence in a heterogeneous host community similar to the result of Devkota (2003). The extremely narrow host range of Viscaceous mistletoes of the Godawari area could be the result of the behaviour of dispersers as suggested by Kuijt (1969).

HMG/N (1986) reported nine mistletoes species from the Kathmandu Valley; HMG/N (1997) recorded six mistletoes species from Phulchoki and Godawari area of Kathmandu Valley; and HMG/N (2003) listed one mistletoe species (*Scurrula parasitica*) from the Royal Botanical Garden, Godawari, Kathmandu Valley. The present study recorded *Macrosolen cochinchinensis*, *Scurrula gracilifolia* and

*Viscum loranthei* as new records for Kathmandu Valley and it maintained the mistletoes species 12 for the Valley.

**Distribution and host range** — The distribution of mistletoes in natural plant communities is never uniform. It is altered by the microclimate such as temperature, sunlight, slopes, aspect, etc. Mistletoes were abundantly seen in forest fringes, roadsides and semi disturbed sites. Marginal forests located at warm sunny slopes affected by human activities create open areas and provide better opportunities for mistletoes habitat (Devkota and Glatzel 2005). The finding is consistent with the finding of Ganguly and Kumar (1976) and Lopez et al. (2002). The marginal areas of the forest are also better habitats for mistletoes pollinator and disperser bird species (Ladley and Kelly 1996).

The host species diversity was noticeable in study area. Most of them belonged to the three families: Rosaceae, Rutaceae and Fagaceae. The families Lauraceae, Rosaceae and Fagaceae were most parasitized in Kathmandu Valley (Devkota and Acharya 1996) and Rosaceae, Lauraceae and Anacardiaceae in Central Nepal Himalayas (Devkota and Glatzel 2005). Possibly the host families Rosaceae, Lauraceae and Fagaceae are the most preferred for mistletoes species.

Total 38 host species were parasitized by *Scurrula parasitica* (Loranthaceae) and 25 species by *Helixanthera ligustrina* (Loranthaceae) (Table 1). *Scurrula* had diverse host range. Wide host range of *Scurrula* and *Helixanthera* shows that they are more generalist and successfully infest as many hosts as encountered, a pattern consistent with the Barlow (1991). The aggressive nature of the genera *Scurrula* and *Helixanthera*, infesting a large number of hosts in the Godawari area, are similar with the results of Devkota (2003) in the Annapurna conservation area, Nepal and

Devkota and Acharya (1996) in the Kathmandu Valley. Results of this study are consistent, some extent, to a wide range of hosts reported by Ganguly and Pal (1975), Hawksworth et al. (1993) and Pundir (1995) for Loranthaceous mistletoes.

Almost every tree of *Celtis australis* was infested by *Viscum articulatum* in Phulchoki area showing high preferences towards a particular host. Similarly, presence of *Salix babylonica* tree in the botanical garden was the surest indication of the occurrence of *Scurrula parasitica*. Affinity of *Macrosolen cochinchinensis* with the host *Schima wallichii* and *Helixanthera ligustrina* with *Melia azedarach* was remarkable. Observations showed that 60 percent of *Melia* trees were infested by *Helixanthera* and 52 percent of the *Schima* trees were parasitized by *Macrosolen*. Matured trees were found to be infested than the younger ones. A matured *Castanea sativa* tree was infested with five mistletoes species such as *Scurrula elata*, *S. parasitica*, *S. pulverulenta*, *Loranthus odoratus* and *Viscum loranthei*. Of the five, later one was found as an obligatory epiparasite on *L. odoratus*. Similarly, matured host trees *Populus deltoids* were parasitized by four mistletoes species *Helixanthera ligustrina*, *Scurrula elata*, *S. parasitica*, and *S. pulverulenta*, and *Pyrus pashia* by three mistletoes species *Macrosolen cochinchinensis*, *Scurrula pulverulenta* and *Viscum album*. Number of infested shoots per tree was higher in *Zizyphus incurva*, *Populus deltoids* and *Callistemon citrinus*. Analysis revealed that the species *Castanea sativa*, *Populus deltoids*, *Callistemon citrinus*, *Zizyphus incurva* and *Pyrus pashia* were the most common hosts having the largest number of mistletoes infestations. More attention should be paid to conserve these host species for the enrichment of mistletoes diversity in Godawari-Phulchoki area.

The occurrence of *Viscum loranthei* as an

Table 1. Host list of mistletoes species in Godawari – Phulchoki area, Kathmandu Valley, Nepal

Family	Host species	Mistletoe species										No.
		HI	Lo	Mc	Se	Sg	Spa	Spu	Va	Var	VI	
Aceraceae	<i>Acer cissifolia</i> K. Koch.						*					1
	<i>Acer mono</i> Maxim.							*				1
	<i>Acer</i> sp.	*			*		*					3
Anacardiaceae	<i>Choerospondias axillaris</i> (Roxb.) B. L.						*					1
	Burt & A. W. Hill.											
Apocynaceae	<i>Nerium indicum</i> Miller							*				1
Betulaceae	<i>Ulnus nepalensis</i> D. Don				*		*		*			3
Bignoniaceae	<i>Jacaranda mimosifolia</i> D. Don							*				1
Bombacaceae	<i>Bombax ceiba</i> L.							*				1
Caprifoliaceae	<i>Viburnum erubescens</i> Wall.						*					1
	<i>Sambucus hookeri</i> Rehder						*	*				2
Celastraceae	<i>Euonymus hamiltonianus</i> Wall.						*					1
Coriariaceae	<i>Coriaria nepalensis</i> Wall.	*						*				2
Elaeagnaceae	<i>Elaeagnus parvifolia</i> Wall. ex Royle						*					1
Ericaceae	<i>Rhododendron arboreum</i> Smith	*										1
Euphorbiaceae	<i>Mallotus philippinensis</i> (Lam.) Mull. Arg.	*										1
Fabaceae	<i>Bauhinia variegata</i> L.							*				1
	<i>Dalbergia sissoo</i> Roxb. ex. DC.				*							1
Fagaceae	<i>Castanea sativa</i> Soul.	*	*		*		*	*				5
	<i>Castanopsis indica</i> Drake	*	*	*	*							4
	<i>Castanopsis hystrix</i> Miq.		*									1
	<i>Quercus glauca</i> Thunb.		*		*					*		3
Flacourtiaceae	<i>Xylosma controversum</i> Clos	*										1
Juglandaceae	<i>Carya illinoensis</i> Koch						*					1
	<i>Juglans regia</i> var. <i>kamaonia</i> C. DC.							*				1
Lamiaceae	<i>Colebrookea oppositifolia</i> Sm.						*					1
Lauraceae	<i>Cinnamomum camphora</i> (L.) J. Presl.	*		*								2
	<i>Litsea monopetala</i> (Roxb.) Pers.	*										1
	<i>Persea odoratissima</i> (Nees) Kosterm	*	*	*	*							4
Loranthaceae	<i>Loranthus odoratus</i> Wall.										*	1
	<i>Macrosolen cochinchinensis</i> (Lour.) Van Tiegh										*	1
	<i>Scurrula pulverulenta</i> G. Don						*					1
	<i>Woodfordia fruticosa</i> (L.) Kurz							*				1
Magnoliaceae	<i>Magnolia saulangeana</i> Lennei	*										1
Malvaceae	<i>Hibiscus mutabilis</i> L.						*					1
Meliaceae	<i>Melia azedarach</i> L.			*				*				2
	<i>Toona ciliata</i> M. Roem.	*						*				2
Moraceae	<i>Ficus auriculata</i> Lour.						*					1
	<i>Morus alba</i> L.						*					1
Myrsinaceae	<i>Maesa chisia</i> D. Don	*		*			*					3
	<i>Myrsine semiserrata</i> Wall.	*			*		*					3
Myrtaceae	<i>Callistemon citrinus</i> (Curtis) Skeels				*		*	*				3
Nyctaginaceae	<i>Bougainvillea glabra</i> Choisy						*					1
Oleaceae	<i>Ligustrum nepalense</i> Wall.	*					*					2
Pinaceae	<i>Pinus roxburghii</i> Sargent				*							1
Rhamnaceae	<i>Rhamnus napalensis</i> (Wall.)						*					1
	<i>Zizyphus incurva</i> Roxb.						*	*				2
Rosaceae	<i>Prunus cerasoides</i> D. Don	*					*	*				3
	<i>Prunus domestica</i> L.	*			*		*	*				4
	<i>Prunus napaulensis</i> (Ser.) Steud.							*				1
	<i>Prunus persica</i> (L.) Batsch						*					1
	<i>Pyrus communis</i> L.	*				*	*					3
	<i>Pyrus pashia</i> Buch.-Ham. ex D. Don			*			*	*	*			4
	<i>Rosa brunonii</i> Lindl.						*					1
	<i>Sranvaesia nussia</i> (D. Don) Dence				*							1
Rutaceae	<i>Citrus aurantium</i> L.						*	*				2
	<i>Citrus maxima</i> (Burm.) Herr.						*					1
	<i>Citrus limon</i> (L.) Burm. f.						*					1
	<i>Citrus jambhiri</i> Lush.						*	*				2
	<i>Zanthoxylum armatum</i> DC.						*					1

Table 1. Continued.

Family	Host species	Mistletoe species										No.
		HI	Lo	Mc	Se	Sg	Spa	Spu	Va	Var	VI	
Salicaceae	<i>Populus deltoids</i> Marsh.	*			*		*	*				4
	<i>Salix babylonica</i> L.	*					*					2
	<i>Salix</i> sp.	*			*		*					3
Symlocaceae	<i>Symplocos paniculata</i> (Thunb.) Miq.	*					*					2
	<i>Symplocos pyrifolia</i> Wall. ex G. Don	*										1
Taxodiaceae	<i>Metasequoia glyptostroboides</i> Hu & W. C. Cheng								*			1
Theaceae	<i>Schima wallichii</i> Choisy	*		*								2
	<i>Eurya acuminata</i> DC.				*							1
Ulmaceae	<i>Celtis australis</i> L.	*								*		2
Verbenaceae	<i>Duranta erecta</i> L.						*					1
Total number of parasitized species		25	5	7	15	1	38	22	2	2	2	

HI: *Helixanthera ligustrina*, Lo: *Loranthus odoratus*, Mc: *Macrosolen cochinchinensis*, Se: *Scurrula elata*, Sg: *Scurrula gracilifolia*, Spa: *Scurrula parasitica*, Spu: *Scurrula pulverulenta*, Va: *Viscum album*, Var: *Viscum articulatum*, VI: *Viscum loranthei*, No: Number of host species.

obligate epiparasite on *Loranthus odoratus* and *Macrosolen cochinchinensis*, is consistent to the observations of Pundir (1994), may be due to the reason as suggested by Visser (1982) when two mistletoes fruit at the same time and birds will tend to wipe off seeds of one on branches of others. Observation of *Scurrula parasitica* as hyperparasite on *S. pulverulenta* in study area is similar to the findings of Glatzel and Balasubramaniam (1987).

### Conclusion

Total 10 mistletoes species; seven belonging to five genera under Loranthaceae and three belonging to genus *Viscum* under Viscaceae were recorded. The species parasitized 69 host species belonging to 57 genera from 38 families. Loranthaceous mistletoes ranged over the large number of host species belonging to different unrelated families. Single species: *Scurrula parasitica* (Loranthaceae) parasitized 38 host species followed by *Helixanthera ligustrina* (Loranthaceae) 25 species. *Macrosolen cochinchinensis*, *Scurrula gracilifolia* and *Viscum loranthei* are new records for the Kathmandu Valley. Tall and matured trees

were better habitats for mistletoes establishment as they were providing adequate space for attachment and found with multiple infections of different mistletoes species. The host trees *Callistemon citrinus*, *Castanea sativa*, *Populus deltoids*, *Pyrus pashia* and *Zizyphus incurva* were the most important because of their capacity of supporting the largest number of mistletoes infestations.

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M. P. デヴコッタ<sup>a</sup>, R. M. クンワール<sup>b</sup>: ネパール・ゴダワリ-プルチョキ地域のヤドリギ類

ネパール・ゴダワリ-プルチョキ地域において、ヤドリギ類各種の多様性、分布、宿主について調べた。その結果、38科57属に渡る69種の宿主に10種のヤドリギ類が寄生していることが分かった。宿主の多くはバラ科、ミカン科、ブナ科であった。10種のヤドリギ類のうち4種はヤドリギ科 *Scurrula* 属であった。 *Scurrula parasitica* が

*S. pulverulenta* に高次寄生すること、そして *Viscum loranthi* が *Loranthus odoratus* と *Macrosolen cochinchinensis* に条件的体外寄生することが観察された。

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